

Observing Microorganisms at Our Doorstep

Overview

In the rainy season, we observe pits, puddles and drainage covers filled with various material (soil, leaves, water etc.). We often fail to observe such places. Can these puddles or even the soil that is in our immediate surroundings (e.g., lake, pond) become- a local context for learning biology? These life forms, their numbers and even forms change with seasons and vary from place to place. In this learning unit, students will explore our immediate surroundings, i.e. places at our doorstep to learn/understand about tiny life forms (microorganisms) in our local context. Students can report their findings on a site for other schools' students and teachers so that everyone can learn about the diversity of microbes from different locations all over the country.

Minimum Time Required: 4 sessions of 40 minutes.

Learning Objectives

- To identify sources and varieties of microorganisms in our immediate surroundings
- To draw the microorganisms
- To document and share these findings through photos and details of sample, location, etc.

Introduction

In the rainy season, we observe puddles in our school grounds. We feel happy to play in such puddles, by jumping or making/playing with paper boats. In some areas, we see drainage covers that have two holes filled with some material (soil, leaves, water, etc.). We often tend to ignore such places. Do you know that such points i.e. the puddles, the holes in the drainage covers, can be of immense significance for learning/understanding about tiny life forms, and their varieties? As they say, variety is the spice of life!

We have learned about handling and caring of a microscope in our previous unit. Using that knowledge, we will explore such tiny life forms using a microscope.

Are You Familiar With These Ideas?

- Unicellular and multicellular organisms
- Classification of animals
- Familiarity with graph paper

Materials Required

- Immediate environment: soil sample, puddles, drainage wells, pond water, etc.
- Lab based: test tubes, test tube stand, droppers, brush, hand lens.
- Microscope setup: ordinary compound microscope, slides, coverslip, smartphone (as a digital camera); (optional items: ocular eyepiece, stage micrometre, dissection microscope)
- Stationary items: pencil, paper, graph paper, (optional items: marker pen, coloured pencils, post-its notes, stickers)

Task 1: Preparing for Sample Collection

Teachers can begin with inquiry-based discussion to instigate curiosity among students.

In what ways can we make use of our immediate surroundings to learn somethings?

Do you think, whether there is life form in our immediate surroundings? What do you think about the puddles in our immediate surroundings? What are their contents?

Q1. Do you think there is life in those puddles?"

Q2. Will there be life forms in a dry sample (e.g. dry soil)? If yes, where do they come from: soil, water, or air?

Q3. When the wet soil sample dries, what happens to the life forms?

Q4. Will there be life forms in a drop of clear water? Why do you think so?

Q5. What do we call the organisms that are visible under microscope but not by naked eyes?

In your school ground/backyard, locate some puddles filled with water. In some places, we can also locate the drainage covers with two holes that are filled with some materials, like soil, leaves, water, etc. These puddles or holes on the drainage covers may be dry or wet depending on the season, and places. Collect some dry and wet soil sample.

Q6. How will you collect a dry soil sample and a wet soil sample?

If your location is a dry place, (i.e. if there is no puddle) then collect the soil sample with a spoon, place it in a container, add few drops of water, mix it and allow it to settle. If your location is a wet place, then directly collect the sample with a spoon and place it in a container. Label the collected samples with name/id, date, time, location, and mention whether dry sample of wet sample.



Figure 1: Drainage cover



Figure 2: Drainage cover



Figure 3: Puddles



Figure 4: puddles

In the following session, you will be making a slide of the sample and observe under the microscope.

After the task of locating and collecting sample, teachers can facilitate students in preparing the slide and observing it under the microscope. Teacher may need to help students with aligning the slide, focusing with appropriate objective lens, seeing through eyepiece, light adjustment, etc.

Task 2: Observe, Describe, Draw and Record

- Prepare a slide by placing a drop of your sample on the slide and cover it with a cover slip.
- After placing the coverslip, the excess water should be absorbed with blotting paper.
- Observe the slide under 10X objective lens. Explore all the areas of the slide and try to observe the variety of objects that you can see.
- Once you find the location of object to observe change objective lens to higher magnification and try to see the same object but more magnified. Observe the living organisms, note the relative sizes.

We should handle glass coverslips carefully as they are very fragile and break easily. The coverslip confines the water drop in a single plane. It also protects the objective lens from immersion into the water drop.

Do use only the fine adjustment knob when focusing at higher magnification, to prevent crashing into a slide.

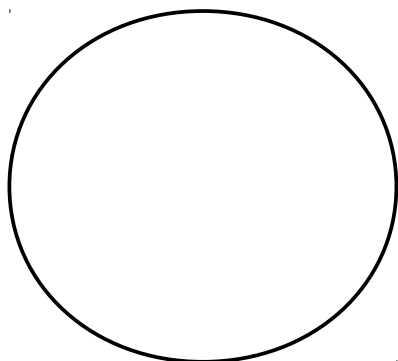
Calculate the total magnification (i.e. magnification of eyepiece x magnification of objective lens) during observing.

Total magnification is _____ times.

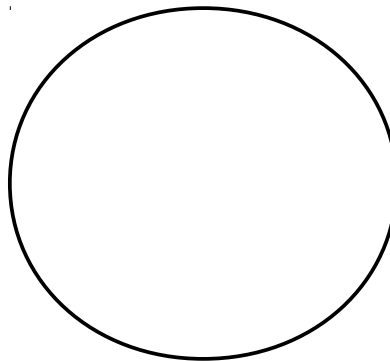
Q1. What do you observe under the microscope (visual field)? Describe it in your own words in terms of number of organisms, sizes, shapes, colours, location, movement, etc.

Q2. Do you think the objects that you see are of living forms or non-living forms? Why do you think so?

Draw what is observed on a paper or graph paper (to be provided). You can draw by first creating a circle of your visual field and using the inside of the circle for drawing almost all the microorganisms that you observe as per the position, size, shape, colour, etc.



Magnification: _____X



Magnification: _____X

Change the magnification and draw the same microorganisms at various magnifications on a paper or graph paper. Follow the same method of drawing inside the circle of visual field.

Take pictures using smartphone or camera of the life forms that you observe in the visual field. Share with the group and teacher/instructor.

After making these observations, and records, students can see each other's or other groups' slides and compare their notes, drawing. Try observing if there is a variety in the life forms among various samples. Discuss the students' observations.

Teachers can also help students to take photographs (using smartphone or camera) of the observations and share on the group.

Note: Identification of microorganisms is not required for this unit.

Q3. Can you think of other samples where microorganisms may be present?

Try to collect at least two samples from your home or surroundings.

Here, students can collect various samples from their surroundings. If students fail to think about such places then, the teacher can suggest them things like garden grass/hay, rotten vegetables, compost/ garden soil, pond/ lake water, spoiled bread slice or chapati, etc. In next session, students can observe the various microorganism from their collected samples.

Task 3: Explore and Observe Microorganisms in Your Surroundings

Prepare a slide for samples collected from your surroundings and observe it under the microscope.

If students bring- garden soil or compost soil then teacher can ask them to observe the ants, insects etc. Add water in the soil sample and allow it to settle down. Then slide can be prepared as done in Task 2.

If Students bring- water samples from ponds or lake then they can directly put a drop of water on the slide.

If students bring- rotten vegetables like beans with white cottony growth on it, bread mould, leaves with white powdery spots etc. then take a drop of water on the slide and mix a small piece of the spoiled part with the water droplet.

The teacher can also extend this task by observing following possible specimens: Supernatant/ clear liquid from idli batter, water used to soak wheat for 1-2 days, sugar-cane juice after 2-3 hours from extraction etc.

Q1. What do you observe under the microscope (visual field)? Describe it in your own words in terms of number of organisms, sizes, shapes, colours, location, movement, etc.

Draw your observations on a paper or graph paper.

Change the magnification and draw the same microorganisms at various magnifications on a paper or graph paper. You can follow the same method of drawing inside the circle of visual field.

Drawing observations will help student to observe minute details of an image. This may also help them to compare and differentiate their two observations like what they observed in the previous sample and in the present sample.

Q2. Have you observed the same objects from both the sample? If no, what was the difference between them?

Q3. If yes, then what would you like to conclude from it?

The teacher can lead the discussion on the variety of organisms present in our immediate surroundings. The teacher can promote discussion by asking questions, such as, *if there are microbes all around us, why are we all not sick?*

Also, discuss the multiple roles of microbes in our environment. Ask, “have you ever seen any colonies of microbes (particularly bacteria and moulds) growing on damp surfaces, or in natural environments? What do you think is happening when microbes grow on something? (The microbes are using the substance as a food source.)

Discuss the important/various roles of microorganisms as decomposers of dead organic material in ecosystems.

The teacher can also introduce the use of stains while observing microscopic organisms. The teacher can ask the difference in images when we used the stain and when we observed without using the stains. Does the stain make the image more colourful? etc.